

A word cloud visualization of terms related to coastal restoration. The words are arranged in a circular pattern, with 'coastal' and 'restoration' being the largest and most central. Other prominent words include 'management', 'research', 'habitat', 'water', 'oyster', 'beach', 'wetland', 'reef', 'lakes', 'river', 'marsh', 'dune', 'bay', 'estuary', 'ecosystem', 'fish', 'salmon', 'wetlands', 'fisheries', 'land', 'management', 'research', 'habitat', 'water', 'oyster', 'beach', 'wetland', 'reef', 'lakes', 'river', 'marsh', 'dune', 'bay', 'estuary', 'ecosystem', 'fish', 'salmon', 'wetlands', 'fisheries', 'land'.

122 CALIFORNIA: Humboldt Bay and Eel River Estuary Intertidal and Subtidal Habitat Goals Project

The synthesis and analysis of intertidal and subtidal habitat descriptions along with recommendations for management, restoration and research will serve as a comprehensive strategy for Humboldt Bay and the Eel River Estuary protection and conservation. The report will be useful to coastal managers, landowners, restoration groups, and tribes. The mapping product will be the first in 10 years of the Humboldt Bay and the first of the Eel River Delta completed with 0.25 m resolution. This will allow detailed habitat mapping by other researchers and managers. Shore bird researchers and NOAA Fisheries scientists have already indicated they will use this product. The map and images will also be useful to the Humboldt Bay Ecosystem Program and to the Humboldt Bay and Eel River Estuary Intertidal and Subtidal Habitat Goals Project. [(mod res)]

486 ILLINOIS/INDIANA: IISG informs Areas of Concern communities as they go through the clean-up process

The Great Lakes Legacy Act (GLLA) provides matching funds to communities to speed up the pace of cleanup of contaminated sediments within Great Lakes Areas of Concern. Since the inception in 2002, five remediation projects and one monitoring project have been completed. Fourteen projects are underway. In 2008, three more remediation projects were signed. At each site, IISG specialists work with the local community through public meetings, newsletters, site visits and informational posters placed at public facilities to help the community stay up to date on the activities at the cleanup sites. The communities also rely on IISG to help them navigate between federal and state agencies. In 2008, the GLLA was reauthorized for two more years and includes new provisions for communities to develop habitat restoration projects at sites where remediation is occurring and provides full funding for evaluating project sites for future remediation. IISG has provided outreach support to two communities that are developing habitat restoration plans after remediation. This effort will expand in the future under the new GLLA. [A/SE-01-08 (wq wq res)]

494 LAKE CHAMPLAIN: Local officials successfully rehabilitate impaired waters with Lake Champlain Sea Grant education and outreach assistance

Statement: All surface streams in Chittenden County, VT, are impaired and the focus of a large scale rehabilitation effort by state and municipal government, often in collaboration with watershed resident organizations. waterways –helping local residents to organize, then educate and assist them to be effective Sea Grant support, through local level awareness and education activities, youth and volunteer water quality monitoring, and training local government officials in pollution prevention and stormwater management technology. Impacts: Significantly lowered bacterial contamination levels: Bacterial levels in impaired streams have dropped significantly. A permanently closed beach at the mouth of Burlington’s Englesby Brook is now fully open for swimming. At Thayer’s Beach in Colchester, VT, the number of days of beach closure have declined significantly. Significant reductions in runoff volume: Rain gardens installed by local officials in the former mill town of Winooski, VT, significantly reduced the volume of stormwater reaching impaired Morehouse Brook. [(res wq)]

104 NORTH CAROLINA: Sea Grant includes oyster focus

Sea Grant has worked with partners on oyster habitat restoration efforts that have resulted in increased attendance at the 2007 Oyster Summit, increased public awareness and greater participation in the conservation and restoration of oysters reefs. In addition, Sea Grant has provided leadership for a coast-wide oyster larvae monitoring program. *[A/EA-10 (res fish)]*

764 NORTH CAROLINA: Reviving River Herring Populations

River herring once provided recreational and commercial opportunities as well as ecological links in coastal foodwebs. However, widespread declines in stocks of river herring along the Atlantic Coast have been attributed to overfishing, decrease in water quality, and loss of habitat. These stocks have been slowly declining over the past century; however, declines in the past 30 years border on collapse. Recent surveys suggest that stocks are continuing to decline despite management efforts, stock enhancement, and measures to restore habitat for adults. Likewise, river herring are culturally and ecologically significant throughout out its range. Sea Grant research is likely to lead to long-term strategies for protecting nursery areas for estuarine dependent fishes. Also the results likely will be used for direct management by which the river herring fisheries could be restored -- fisheries so important to many coastal towns. *[R/MRD-55 (fish ebm res)]*

1422 NORTH CAROLINA: Beach Nourishment Research Results Reviewed by NC Panels

Sea Grant research results have been used by the Science Hazards Panel of the Coastal Resources Commission (CRC) to prepare draft regulations to define sediment compatibility in the rules that control permitting for beach nourishment so as to avoid future repetition of the transformation of beach habitat and loss of beach ecosystem services caused by the Bogue Banks project. In addition, the results of this Sea Grant study have been used in the legislatively mandated Coastal Habitat Protection Plan prepared to enhance fisheries habitat in the State. *[R/CZS-32 (res ebm)]*

1466 NORTH CAROLINA: Sea Grant techniques transferred to varied research

Mass spec methods identified by Sea Grant researchers provide a means to assess success of various management strategies designed to enhance natural N removal. This approach is now integrated into a Virginia oyster restoration study to assess the validity of oyster restoration for nutrient credits. These mass spec and molecular techniques are being applied to studies of soil systems that include Nitrogen fertilizer. Finally the rapid screening tools developed by Sea Grant researchers can be applied to wider spatial and temporal assessment of Nitrogen removal hotspots in estuaries. (NCSG: Microbial Nitrogen Cycling in the Cape Fear River Estuary: Attenuation vs. Recycling and the Effects of a Variable Freshwater-Saltwater Boundary, R/MER-54) *[R/MER-54 (res wq mon)]*

588 OHIO: Sea Grant reduces brownfield creation and expands business

Sea Grant assisted Miceli's Dairy Products acquire land adjacent to its current facility. A parcel of this land previously owned by a plating company was contaminated. Sea Grant helped the company to obtain a county grant and funds from the Clean Ohio Fund to pay for phase I and phase II environmental assessments and remediate this property for future expansion. Miceli intends on building a 50,000 Sq ft addition on to its current facility to expand production. When completed the company plans on hiring 30 new employees. *[A/EP-1 (res unk)]*

1597 WASHINGTON: Sea Grant funds innovative seawall redesign to enhance ecological function in urban nearshore area

The seawall along Seattle's central waterfront is deteriorating and in need of major repairs or replacement, presenting an opportunity to improve the ecological function along an urban shoreline through a redesign that includes increased complexity and surface area. Sea Grant research is evaluating designs to suggest criteria for use in seawall reconstruction beginning as early as 2012. Impact: The redesign encourages creative engineering solutions in design of intertidal structures, integration of intertidal habitat enhancement design features in new construction, and innovative conservation efforts where restoration to natural conditions is not feasible. The research will advance basic ecological knowledge of a significantly altered urban intertidal environment and the ecological mechanisms, processes, and interactions associated with intertidal artificial structures. *[R/ES-66 (res)]*

1617 WASHINGTON: Sea Grant Research Assesses the Role of Ocean Conditions in the Decline of Steelhead Runs on the West Coast

Dwindling runs of anadromous steelhead (*Oncorhynchus mykiss*) have led to harvest reductions and job losses in recreational and tribal fisheries and related businesses. Although millions of dollars are being spent to protect and restore steelhead populations and their freshwater habitats, recent large and unpredictable fluctuations in runs may be due to changes in ocean conditions. Thus, it is difficult to assess the effectiveness of rebuilding efforts without understanding how ocean-climate processes regulate steelhead abundance. Sea Grant research created a long-term biological database (1955-2009) on steelhead in the North Pacific Ocean and mapped known ocean distributions and associated environmental conditions. Preliminary results show decadal-scale changes in the amount of critical thermal habitat for steelhead, which increased from 1960-1990 and has decreased since then. Impact: By harnessing a long-term dataset to address critical gaps in steelhead ecology, Sea Grant research is strengthening the scientific basis for management - especially critical when open ocean conditions are unfavorable for steelhead survival. *[R/F-160 (ebm mon res)]*

121 WISCONSIN: Sea Grant research helps managers in controlling cattails in many locations

Boers' findings led Steven Hall to develop a new approach to controlling cattails in Gardner Marsh (UW-Arboretum), a wetland of about 200 ac that is increasingly dominated by hybrid *Typha*. Research and land care were integrated in a new management plan that the Arboretum adopted. Managers will now rely on the vegetative regrowth and lateral spread of *Carex* into formerly *Typha*-dominated marshes and less

on seed bank resilience. -This research catalyzed a comparative Typha-management study in Michoacan, Mexico, conducted by Steven Hall with Dr. Roberto Lindig-Cisneros (UNAM-Morelia). Hall, Lindig-Cisneros and Zedler (2008) developed a management recommendation for Michoacan, Mexico based on findings that harvesting Typha 4 times per year increased wetland diversity. Results of project were published in Wetlands. -Sally Gallagher worked with The Nature Conservancy and the Eagle Spring Lake Management District Committee in conveying our understanding of the phosphorus dynamics of the wetlands surrounding Eagle Spring Lake, based on Boers' research. Both partners are interested in managing lake levels to enhance biodiversity. Boers' study shows that fluctuating water would more likely limit the shift from sedge meadow to cattail than would a stable water level. -New information on how native wetland plants grow in response to nutrients, water levels, and topsoil addition was used by the Arboretum to transform three new stormwater facilities into 'Stormwater Management Research Facilities' that will use an adaptive restoration approach to test which diversity level (3 vs. 9 species) and which assemblages (randomly drawn species) perform best in a stormwater infiltration bed, conveyance channel, and detention pond. -Students in Zedler's Botany 670 Lab (Adaptive Restoration) worked with the Wisconsin TNC to develop a restoration and vegetation planting plan for two wetlands at the Mukwonago Reserve following the breaching of a berm. -Zedler supervised a Water Resources Managment project for 8 masters students. The class evaluated invasive species problems in the UW-Arboretum's eastern wetlands (200 ac). The group developed an adaptive restoration approach. The WRM report is available on the UW-Arboretum website (<http://uwarboretum.org/research/>). [R/LR-96 (inv res)]

213 CALIFORNIA: Humboldt Bay Cooperative Eelgrass Project

The results of our survey have been useful to shellfish growers in their permit applications. Local managers also use the results when applications for culvert replacement, levee replacement, and highway repairs impact eelgrass I reviewed two proposals for their eelgrass mitigation and monitoring methods and gave my scientific opinion on technical aspects such as sample size, distance between transects, and timing of sampling. From Test Bed data, I could show that sampling between April and September would be more useful as this is the growing season for *Z. marina* in Humboldt Bay. Data collected from monitoring sites at other times of year would be difficult to analyze. Our survey results were used to develop eelgrass monitoring plans for two projects, the Eureka Marsh Culvert Replacement and Mad River Slough Levee repair. [*(mod res mon)*]

944 CALIFORNIA: CALFED: Sacramento River Salmon Preservation

Salmon and water issues collided in a big way in 2008 in California, as federal fisheries managers closed the West Coast salmon season to protect Sacramento River chinook. Soon after, California's governor declared the state in an emergency drought, a measure meant to help the Central Valley's \$20 billion-a-year farm industry obtain more water – water fishermen say the salmon need. With the state's almost 40 million thirsty residents and no substantial sources of fresh water in densely populated Southern California, water shortages are now halting new developments and for fishermen, underscoring the recently deadly link between water use and salmon fishing. CASG is supporting several projects that seek to assist in the state's seemingly untenable water-salmon crisis. Several researchers have developed computer models for predicting the effects of different water management options (diversions, timing of diversions, etc.) on salmon survival and for identifying mortality hot-spots within chinook's migration routes through the Sacramento and San Joaquin River system. Hatchery fish are released in huge numbers in the Bay-Delta, and to assess whether these releases are indeed rebuilding salmon populations, another CASG scientists has developed genetic markers for tracking chinook parentage. At the level of ocean governance, CASG researchers are also looking at regulatory gaps and overlaps that hinder effective salmon preservation. For example, the regulatory agency controlling salmon fishing has no jurisdiction on controlling river flows, and visa versa. IMPACTS: The results of these projects are being shared with the CALFED Bay-Delta Authority (which oversees the water problems on the Sacramento-San Joaquin River Delta) and with relevant stakeholder groups such as the East Bay Municipal Utilities District and the California Urban Water Association. Researchers are also publishing their findings in scientific literature and presenting research at ocean governance conferences. It is up to regulators and managers to decide how to weigh the pros and cons of water management plans and their consequences for farming, urban development and salmon, and its sister issue, riparian ecosystem health. [*(fish res)*]

1168 CALIFORNIA: Improving Beach Ecosystems

Based on this research, beach management permits are now issued with the understanding that raking can be modified to reduce ecological impacts, and the City of Oceanside has changed how it adds sand to beaches to reduce impacts on beach ecology. [*R/CZ-174 (res ebm)*]

1178 CALIFORNIA: Modeling Coastal Processes

We have identified several general categories of users who will benefit from the results of this research: The modeling capability can be used in a predictive mode by local, state, and federal environmental regulators currently setting standards for non-point storm water runoff and Total Maximum Daily Loads for inland streams that discharge to the ocean and for atmospheric emissions. The research will also benefit the operators of municipal and industrial facilities that discharge into impacted embayments who need to understand the impacts of their respective discharges. The research will assist EPA and other regulatory agencies in evaluation of alternative schemes for remediation of contaminated coastal sediments, such as the DDT patch near Santa Monica Bay, currently the focus of a federal Superfund effort. The research will be useful to marine scientists trying to understand how the physical and biogeochemical processes in enclosed embayments interact with the natural aquatic ecosystem. The research will be useful to marine scientists trying to understand where to site marine protected areas. The research will assist scientists in understanding the causes and characteristics of harmful algal blooms in the coastal region. *[R/CZ-193 (prot wq mod res mon)]*

1075 HAWAII: University of Hawaii Sea Grant Research Will Alter Management Strategies for Invasive Mangroves

Project results provide critical information to substantially alter management strategies of invasive mangroves in Hawaii. Specifically, results indicate that mangrove removal should include extrication of below-sediment roots and fiber mats to allow rapid restoration of normal ecosystem structure and function. Otherwise, mangroves may continue to impair ecosystem functions in the Hawaii coastal zone for at least six years. *[R/CR-17 (inv ebm res)]*

133 LAKE CHAMPLAIN: Sea Grant engages retailers to reduce residential use of phosphorous fertilizer

Focus Area: HEALTHY COASTAL ECOSYSTEMS NOAA SG Goal - Widespread use of ecosystem-based approaches to managing land, water and living resources in coastal areas LCSG Goal - Ecosystem-based approaches used to promote a healthy and diverse ecosystem and provide for sustainable human use and enjoyment of Lake Champlain, the basin and surrounding waters. Objective - Decision-makers, planners, and managers apply knowledge of basin ecosystem processes to reduce the effects of environmental stressors and long-term human and ecosystem health. Sea Grant engages retailers to reduce residential use of phosphorous fertilizer. In 2003 organizations in Vermont and New York interested in protecting the health of Lake Champlain joined to form the Green Lawn Coalition. Lake Champlain Sea Grant was a founding member. The group education activity has focused on educating retailers to a) increase the availability of no-phosphorous lawn care alternatives and b) to involve them in point of sale education of consumers about no phosphorus fertilizer. An assessment of the education effort showed three important changes. Fertilizer tonnage reports show amounts of non-farm phosphate-containing fertilizer brought into Vermont for sale to consumers nearly halved, dropped by nearly half, from 294.25 tons in 2003 to 161.2 tons in 2007 (2008 data were not available). The number of phosphorous free lawn care products registered for sale in the state increased dramatically. Although registration data only show that a product was intended for sale in the state, such data are a good proxy for consumer demand for a product. There were 80 phosphorous free lawn care products registered in 2003, at the start of the education effort. The number grew to 145 in 2006 and nearly tripled to 221 in

2008. The number of retailers also grew, from less than ten before 2003 to 41 in 2008 - 29 in Vermont and 12 in the New York portion of the basin. *[A/M-1 (ebm res wq wq)]*

1342 MARYLAND: Inform food web models for improved ecosystem-based fisheries management

Results of the three-year project are being incorporated in food web models under development by the NOAA Chesapeake Bay Office (the Chesapeake EcoPath model) and with funding from the EPA Chesapeake Bay Program (Chesapeake TroSim). The goal of both of these modeling efforts is to provide tools that will facilitate a shift toward ecosystem-based fisheries management in Chesapeake Bay, and to predict food web effects of declining and restored oyster populations. *[R/P-54 (mod ebm res)]*

150 MICHIGAN: Sea Grant Provides Planning Support for Michigan's Northeast Region

More than 50 partner organizations, state agencies, and three county governments collaborated on a two-year Sea Grant-led project to stimulate economic development and sustainability in Michigan's northeast region. In 2007, project research teams finalized five technical assessments characterizing the status of life in northeast Michigan, focusing on socioeconomic, ecological, cultural, planning and zoning, and sustainable design. The Northeast Michigan Integrated Assessment (NEMIA) has resulted in unprecedented regional collaboration. Notable outcomes include: 1) cooperation between the NOAA Thunder Bay National Marine Sanctuary and Michigan Department of Natural Resources to incorporate cultural interpretation into MDNR sites; 2) development of a regionally coordinated management plan for three coastal state parks with citizen input; 3) the collaborative capacity to apply for a People and Land (PAL) grant supported by the W K Kellogg Foundation; 4) selection of northeast Michigan by Michigan State University Extension as a pilot community for regional economic development; 5) successful state funding to enhance recreational opportunities for paddlers along northern Lake Huron; and 6) selection of the northeast region to receive funding from the Great Lakes Fishery Trust to support Great Lakes place-based education. In all, a total of \$195,000 was secured as a result of the NEMIA process, with \$70,000 pending. *[(soc train prot res)]*

1411 NEW YORK: Sea Grant researchers assess New York's capacity to implement the Regional Great Lakes Restoration Strategy

This project undertook an analysis of New York's capacity to fully participate in the regional Great Lakes Regional Collaboration Strategy to Restore and Protect the Great Lakes. This strategy is very thorough and sets some goals for restoration of the lakes. A gap analysis was performed to assist Great Lakes leaders in assessing New York's capacity to carry out its role in regional efforts to Great Lakes ecosystem restoration. IMPACT: The research team found that New York State has the legal and institutional capacity to implement most of the Strategy's recommended action items, and also found that the decision-makers and those who are affected are not necessarily aware of the programs nor their connections to the Great Lakes. New York State's new Ocean and Great Lakes Ecosystem Conservation Council will communicate and coordinate among agencies with Great Lakes responsibilities. *[A/o-7 (res)]*

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1126 CALIFORNIA: Artificial Reef as Mitigation for Power Plant Operations

CASG researchers studied fish production on three differently designed pilot artificial reef modules, as part of a five-year pilot study for the California Coastal Commission, which, among other things, approves mitigation projects for development in the coastal zone. Impact: The findings of the project were incorporated into the final design of a 150-acre artificial reef off Orange County. Scientists say the \$40-million dollar reef is one of the largest and most advanced in the world. The reef will provide the foundation (substrate) for a giant kelp forest and associated macro algae, invertebrates and fish. By design, it will produce about 28 tons of kelp bed fishes, about the same as would be produced by a natural reef. This man-made reef is being constructed to repair damage from a nuclear power plant, owned by Southern California Edison. The construction began in June of 2008. The LA Times published a June 12, 2008 article: <http://www.latimes.com/news/local/la-me-kelp12-2008jun12,0,6812145.story> [R/F-188 (res)]

1131 CALIFORNIA: Black Abalone Restoration

Husbandry techniques are being developed so that black abalone, which is a candidate for listing, can be bred in captivity for "outplanting." Project results have made significant changes in the perceived population dynamics of black abalone; in particular, the reproductive ecology of the species. As an endangered species under the federal ESA, restoration efforts will require a sufficiently thorough

understanding of the species' reproductive potential. Black abalone require dense spawning aggregations to ensure successful fertilization and limitations to reproductive success will further inhibit recovery. The discovery of reproductive limitations has therefore prompted additional research question concerning the mechanisms of this pattern. *[R/F-200 (end res)]*

1192 CALIFORNIA: Restoring Wetlands at NOAA NERR

R/CZ-190, Results of Sea Grant studies of the invasion ecology of salt cedar (tamarisk) at NOAA's Tijuana River National Estuarine Research Reserve (NERR) are now a core element of its Adaptive Invasive Species Management Plan. The research has led the NERR to prioritize removing tamarisk from salt marsh habitats over upland areas. Because some local agencies have been reluctant to remove tamarisk, the NERR is in the process of conveying the results of this project through its formal Management Authority to relevant entities. *[R/CZ-190 (res inv)]*

1219 CALIFORNIA: White Abalone Restoration

California Sea Grant researchers developed a genetic marker for positively identifying endangered white abalone. Experiments were conducted to test the efficacy of antibiotics in treating abalone disease. Husbandry techniques are being developed so that white abalone can be bred in captivity for "outplanting." The genetic marker was used to show that one of the "white abalone" collected for the recovery program, led by NOAA Fisheries, was in fact a pinto abalone. The marker will prevent inadvertent hybridization of white abalone. *[R/F-196 (dis end res)]*

222 CONNECTICUT: Sea Grant Collaborates on Dune Restoration

Connecticut Sea Grant, working with a local land trust and several private companies, restored an active dune system of 750 ft bordering Long Island Sound after two spring storms severely eroded the dune system in 2007. A plan was developed to restore the dunes using Filtrex tubing - an erosion control material which had not previously been used in a coastal environment. Donations of materials, equipment use, and expertise reduced the total cost of the restoration project total cost to ~\$30,000, one-third of what it would have otherwise cost. After seeing the success of this restoration project with the Filtrex tubing, the Connecticut Department of Environmental Protection decided to use the same methodology and materials on an eroding dune system at a state park on the coast. *[A/E-1 (res mon)]*

224 CONNECTICUT: Sea Grant dune restoration reflects ecological and economic importance

Connecticut Sea Grant worked with a local land trust and several private companies to restore 750 ft of an active dune system bordering Long Island Sound in 2007-2008. The dune provides partial protection for the recently-restored 10-acre Lynde Point tidal marsh in the lower Connecticut River tidelands that have been designated Wetlands of International Significance, and is part of 4+ acres donated by the late Katharine Hepburn to the land trust for open space protection. Abutting the former Hepburn home (which sold for \$6M, the highest ever for a property in this town), the value of this less than 1-acre dune

and beach is reflected by its assessment at ~\$69,400 (2.3 times the per-acre assessment for wetlands and ~3 times that of a typical per-acre assessment for unbuildable lots); adjacent coastal buildable lots are valued at \$3M per acre. [A/E-1 (*res prot*)]

225 CONNECTICUT: Sea Grant fills local need for habitat restoration expertise

In just three years, Connecticut Sea Grant's new coastal habitat restoration extension program has led to involvement or input in eight restoration projects with land trusts, local communities, one college, one university, and the US Fish and Wildlife Service. The habitats undergoing restoration include coastal forests, dunes, meadows, and shoreline. Connecticut Sea Grant is also assisting the EPA's Long Island Sound Study Habitat Restoration Team in developing better guidelines that will facilitate the submission of more successful proposals for habitat restoration funding. [A/E-1 (*res*)]

261 CONNECTICUT: Connecticut Sea Grant Promotes Coastal Habitat Restoration

Many acres of land in coastal Connecticut towns (both upland and wetland) owned by municipalities, land trusts and individuals are degraded due to lack of proper management, invasive species, and disruption of natural processes. Connecticut Sea Grant is assisting coastal landowners (municipalities, land trusts, individuals, State of CT) with coastal habitat restoration projects including but not limited to: improving habitat for rare species, invasive species removal, reintroduction of natural processes to coastal habitats, and coastal habitat improvement (e.g. coastal riparian buffers). Impact: • Two UConn Master Gardeners worked with CTSG to develop a management plan for two coastal pond borders heavily infested with invasive plant species. The Master Gardeners met with and educated the landowners (a beach club association), and having received permission to proceed, have management actions underway. One Master Gardener co-authored an article on the project for Wrack Lines. • An active dune system of 750 ft bordering Long Island Sound has been restored after two spring storms severely eroded the dune system in 2007. Working with CTSG and several private companies, a plan was developed to restore the dunes using Filtrex® tubing - an erosion control material which had not previously been used in a coastal environment. Two companies donated materials, use of equipment, and expertise, such that the restoration project total cost was only approximately \$30,000 – a third of what it would have otherwise cost. With oversight from CTSG and NRCS scientists, as well as one of the private companies, The Lynde Point Land Trust (LPLT) has taken a lead role in dune restoration, particularly in educating local residents about the need to preserve and protect dunes. The LPLT has submitted a Long Island Sound License Plate Fund grant with J. Barrett to erect dune fencing and do more plantings to aid in the stabilization and growth of the dune system. After seeing the success of this restoration project with the Filtrex® tubing, the Connecticut Department of Environmental Protection is going to use the same methodology and materials on an eroding dune system at a state park on the coast. • A management plan to control invasive plant species along the shoreline at the coastal UConn Avery Point campus was developed with a seminar given to UConn faculty, students and staff. Two high school student interns contributed to this project in 2008, and an undergraduate GIS class will undertake mapping of the invasive plants on an annual basis. • After only one year of active management, a Connecticut population of the regionally rare plant, New England Blazing Star, (*Liatris scariosa* var. *novae-angliae*) increased from 460 individuals to 3,399 plants. With oversight from CTSG and NRCS scientists, The Lynde Point Land Trust (holder of a conservation easement and responsible for any management of the meadow) and the Borough of Fenwick (owner of the property) have taken the lead

role in coordinating the management of this rare plant population and are active in its protection. They have moved fencing, erected signage, and are educating neighbors. This local involvement and commitment is critical for the long term viability of this rare plant population. In addition, GPS equipment is being used to monitor the rare plant population providing a new example for Extension educators as to how this technology can be used, as well as aiding in the long term monitoring of the population. [(res)]

332 DELAWARE: Sea Grant project demonstrates oyster restoration in tidal river

Through a grant from the National Fish and Wildlife Foundation, Sea Grant researchers and extension specialists tested various options for oyster restoration in a tidal stream. They discovered natural recruitment of oysters occurring in sub-tidal and intertidal areas of the Broadkill River (a tributary of the Delaware Bay). The investigators concluded that a stock enhancement strategy to increase the amount of shell available for new recruitment can lead to significant restoration efforts in tidal rivers and streams. [A/I-1 (fish res)]

1243 FLORIDA: Improving efforts to mitigate loss and establish essential "worm rock" habitat

The results of this project should help guide managers in planning more effective mitigation for the loss of essential "worm rock" hard-bottom habitat caused by beach renourishment projects on Florida's east coast. [R/C-E-53PD (res)]

260 HAWAII: Hawaii Sea Grant Supports Dune Restoration Efforts on Maui

Coastal dunes at Kamaole III Park in Kihei, Maui, have long suffered from degradation due to grading, foot traffic, and lack of vegetative ground cover. Zoe Norcross-Nu'u, a Hawaii Sea Grant Coastal Processes Extension Agent based in Maui, worked with the Maui Parks Department and a community non-profit volunteer group, Hoaloha Aina, to design, obtain funding for and implement a dune restoration project at the park. The project, which was begun in 2005, is experiencing great success. The second phase of the project is now underway and will involve dune enhancement with sand dredged from the Kihei Boat Ramp beginning September 17, 2007. Sand placement will be followed by planting with native coastal plants, sand fencing for temporary dune protection and post-and-rail fencing for long-term dune protections, as well as wooden beach access stairways to prevent erosion at high-use areas. Impact: The project has been educational to the Kihei community for residents and visitors alike. The project was the recipient of the National Association of County Parks and Recreation Officials Award in the Environmental/Conservation category, awarded on July 16, 2007 in Richmond, Virginia. This award was recognized by the Maui County Council on August 21, 2007, with the adoption of Resolution No. 07-98, "Congratulating the Kamaole III Beach Park Sand Dune Restoration Project for Winning the 2007 National Association of County Parks and Recreation Officials Award in the Environmental/Conservation Category," in which Norcross was recognized as a contributor. [(ebm res prot)]

268 HAWAII: Sea Grant establishes nearshore ecosystem restoration project in Waikiki

Hawaii Sea Grant initiated a multi-year project to work with the State Department of Land and Natural Resources, Waikiki Improvement Association, Waikiki Aquarium and other local partners to undertake a comprehensive restoration and maintenance of Waikiki Beach and the nearshore coral reef habitat. The project proposes to use periodic beach replenishment of “recycled” sand that is strategically removed from the nearshore coral reef. This activity may help to restore and maintain coral reef habitats that are presently buried in sand that has eroded offshore over decades of shoreline erosion activity. This beach replenishment effort would be combined with an education outreach program aimed at building awareness and stewardship among tourists, the local community, and key decision makers based on Hawaii Sea Grant's ReefTeach, ReefWatcher, ReefTalk and the Hanauma Bay Education Program. This would be a clear case of environmental restoration leading to economic, social, cultural and recreational opportunities. This project would also be a first, essential step in building an “aquarium without walls,” in which a natural coral reef ecosystem with its attendant community of fish and invertebrates would be a strong attraction for tourists and Hawaii residents, provide recreational business opportunities and demonstrate Hawaii's commitment to habitat restoration. Impacts: 1) Hawaii Sea Grant secured two years of funding from the Harold K. L. Castle Foundation in September 2007 to hire a project coordinator to establish local citizen and tourist engagement programs in marine stewardship. Hawaii Sea Grant also established a Memorandum of Agreement in February 2008 with the Waikiki Aquarium to coordinate, whenever possible, the activities of our ocean science researchers, extension professionals and educators toward the ambitious goal of restoring and maintaining Waikiki Beach and the nearshore coral reef habitat. Finally, Hawaii Sea Grant received a letter of endorsement from the Waikiki Improvement Association (WIA), a private, nonprofit organization dedicated to making Waikiki a great place to invest, work, live and play. In the letter, WIA stipulated that it will assist Hawaii Sea Grant in reaching its project goals by serving as a liaison and facilitator in developing collaborative partnerships among the various stakeholders including, but not exclusive to, businesses, the visitor industry, property owners, government, and residents. In addition, WIA is providing prime office space in the Waikiki Trade Center for the Sea Grant Waikiki Coastal Coordinator. 2) Hawaii Sea Grant hired Jennifer Barrett in June 2008 to serve as the Waikiki Coastal Coordinator. The extension agent identified key stakeholders to engage and then held introductory meetings with them to invite their participation and seek their input on the project. The stakeholders included the Surfrider Foundation, Oahu Chapter, Waikiki Community Center, Hawaii Ecotourism Association, Interpret Hawaii, Honolulu Star-Bulletin (Susan Scott Ocean Watch columnist), The Nature Conservancy of Hawaii, Malama Maunaloa, Hawaii Ocean Observing System (HiOOS), National Marine Fisheries Service Pacific Islands Regional Office, State Department of Land and Natural Resources (Office of Conservation and Coastal Lands, Division of Aquatic Resources, Artificial Reef Program, Aquatic Invasive Species Coordinator, Local Action Strategy Coordinators). The agent also participated in the U.S. Coral Task Force meeting held in Kona in August 2008 to network and identify potential project partners, engaging additional stakeholder groups, formalizing several more partnerships within the Waikiki community. 3) The agent also identified potential funding opportunities to support project activities in Waikiki and submitted grant proposals to these funding agencies. The agent was successful in securing funding from the Hawaii Tourism Authority's Natural Resource Program. This funding leverages existing extramural funds from the Harold K.L. Castle Foundation and are being directed to launch a community stewardship program entitled Reef Watch Waikiki in spring 2009. 4) In lieu of planning for a Waikiki ReefTalk program, the agent co-coordinated an Ocean Awareness Training program for over 100 participants in partnership with the NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary and eight marine conservation organizations. The 15-hour training took place twice a week in November 2008 and involved the

coordination of 15 cooperating agencies. Lecture topics covered included marine mammals, sea turtles, Hawaiian culture, oceanography and geology, Hawaiian reef organisms, coral reef biology and ecology, water quality and marine debris. Field projects included reef surveys, sea turtle and monk seal interpretation, and marine mammal data management. The training was offered free of charge, open to the public, and designed for volunteers who have an interest in working in marine education or tourism. Participants who complete the training received a CORAL (Care of our Culture, Reefs and Animal Life) certificate. [*res edu train*]

1075 HAWAII: University of Hawaii Sea Grant Research Will Alter Management Strategies for Invasive Mangroves

Project results provide critical information to substantially alter management strategies of invasive mangroves in Hawaii. Specifically, results indicate that mangrove removal should include extrication of below-sediment roots and fiber mats to allow rapid restoration of normal ecosystem structure and function. Otherwise, mangroves may continue to impair ecosystem functions in the Hawaii coastal zone for at least six years. [*R/CR-17 (inv ebm res)*]

1309 ILLINOIS/INDIANA: Sea Grant informs Legacy Act communities

The Great Lakes Legacy Act authorizes \$270 million to remove hundreds of tons of contaminated sediment that has built up over the years and left some local waterways severely polluted. A number of communities are benefiting from this federal funding with many more under discussion. Throughout, Illinois-Indiana Sea Grant is on the ground, informing, educating, and supporting these communities as they go through this process. IISG has worked with communities to plan their next steps and consider how they can make the most of their newly cleaned-up environment. For example, IISG has helped foster community involvement and feedback in the development of an Ecological Restoration Master Plan for the Muskegon Lake and Ruddiman Creek shoreline. [*A/ (res wq edu)*]

251 LAKE CHAMPLAIN: Sea Grant develops a new method for water chestnut control

Researchers testing ultrasound treatment for water chestnut control found that water chestnut plants were severely damaged after 2 seconds of 20 kHz ultrasound exposure. Plant mortality rates after 14 days ranged from 86.67% to 96.67%, depending on the part of the plant treated. Aiming ultrasound directly on water chestnut stems had the greatest effect. Ultrasound treatment had no effect on mortality or behavior of two exposed fish species. Cost benefit analyses and more comprehensive environmental assessments are underway. Impact: Ultrasonic control has the potential to successfully eradicate water chestnut plants, supplementing or even replacing current control methods. [*A/M-1 (inv res)*]

1315 LOUISIANA: Effects of freshwater inflow on oyster resources

Data from this project are critical to understanding the effects of freshwater diversions, one of the key restoration/coastal management tools identified in the state coastal management plan. As Louisiana proceeds with more diversions, data from this project will guide the location and the management of the freshwater diversion. *[R/GOI-33 (wq res)]*

226 MAINE: Cleaner beaches equals healthier swimming

The Maine Healthy Beaches Program expanded to two new beaches in 2008. Monitors in the program documented improvements in water quality at eight beaches, while the total number of beach advisories decreased in 2008. Program staff attribute the improvements to special studies and sanitary surveys, marine pumpout and education/outreach efforts, and local actions to address malfunctioning subsurface wastewater disposal systems and improvements to stormwater systems. *[A/08-01 (res wq wq)]*

569 MAINE: Beach managers use volunteer data to make decisions

Working with the Maine Department of Environmental Protection and Maine Geological Survey, many towns used data from the Maine Beach Profiling Program in 2008. At Willard Beach in South Portland, profiling data helped inform dune restoration and access improvements. Scarborough was able to evaluate seawall replacement options at Higgins Beach, and to evaluate beach nourishment performance at Western Beach. Saco assessed accelerated erosion rates and potential mitigation at Ferry Beach. Wells evaluated a nourishment project at Wells beach, and used data in their permit application for seawall improvements. Finally, Ogunquit data helped illustrate discussions of sand fence replacement and piping plover management. The value of beach profiling data generated by program volunteers is clear from the \$4,900 contributed by the towns of Ogunquit, Kennebunk, Kennebunkport, and the cities of Biddeford and South Portland, as well as the Maine Department of Conservation to support the program. *[A/08-01 (mon res)]*

1331 MAINE: Sea Grant helps town clean up its water and beaches

Despite unsafe bacteria levels for recreational water users, the state had decided not to manage the Lincolnville Beach area due to lack of staff resources. Based on monitoring by the MET and Maine Healthy Beaches Program, and the success of previous work in cleaning up contamination in area waters, the Town of Lincolnville decided to make Ducktrap Beach a priority recreational asset and a priority for management, and committed to working with MET to identify contamination sources. Town voters approved the plan, and the state gave the 25-acre beach area to the town as a 25-year free lease. *[A/EXT-06 (mon wq res)]*

1341 MARYLAND: Improved incident light algorithms resulted in a modification of the SAV water quality criteria used by management in the Chesapeake Bay

Research funding supported development of an optical water quality model to predict the diffuse attenuation coefficient for PAR based on commonly monitored water quality variables in the Chesapeake Bay. The results of this research were incorporated into the web version of the diagnostic tool for setting water quality targets for restoration of SAV used by managers in state and federal agencies throughout the Chesapeake Bay region. *[R/P-53 (wq res mod mon)]*

263 MICHIGAN: Sea Grant Contributes to Key Economic Report on Restoring Great Lakes

Michigan Sea Grant led a panel of scientific experts in an analysis of the potential ecological impact of restoration activities called for in the Great Lakes Regional Collaboration Strategy. Economists then used the results to determine the economic benefits of restoring the Great Lakes in a report published by the Brookings Institution. *Healthy Waters, Strong Economy: The Benefits of Restoring the Great Lakes Ecosystem*, concludes that people and communities of the Great Lakes region stand to gain at least \$50 billion in long-term economic benefit from an investment of \$20 billion now on Great Lakes restoration. The report is being used by regional and national entities to educate Congress on the significance of supporting restoration activities to the regional and national economies. For example, the recent re-authorization of the Great Lakes Legacy Act, which addresses remediation of contaminated sediments in Great Lakes areas of concern, may be linked to the conversation and profile that was engendered by the Brookings Institution report. *[(res soc)]*

266 MICHIGAN: Sea Grant Helps State Quantify Economic Value of Restoration

Michigan's Office of the Great Lakes asked Sea Grant to estimate the economic benefits to Michigan of implementing the Great Lakes Regional Collaboration Strategy to restore the Great Lakes. The Strategy now forms the basis for a \$475M annual appropriation for a Great Lakes Restoration Initiative introduced in the President's 2010 budget. Sea Grant's analysis was used to support a comprehensive restoration plan for Michigan's Great Lakes coasts which has been distributed to Congressional representatives and state legislators (*The Michigan-Great Lakes Plan: Our Path to Protect, Restore, and Sustain Michigan's Natural Treasures*). Sea Grant investigators modified a previous analysis done for a Brookings Institution report (*Healthy Waters, Strong Economy: The Benefits of Restoring the Great Lakes Ecosystem*) and estimated that restoring the Great Lakes could produce \$7-13 billion in benefits to the state of Michigan. The report describes how restoration will benefit tourism and outdoor recreation, reduce water treatment costs, and help attract and retain businesses and workers in Michigan. *[(soc res wq)]*

267 MICHIGAN: Helping Communities Effectively Reduce Stormwater Runoff

A Sea Grant-supported research team has developed tools that allow coastal communities to compare runoff-reduction strategies and to identify the places where new stormwater structures can have the most impact. In collaboration with municipal officials from Spring Lake watershed, researchers have developed a model of how suspended solids, phosphorus, and nitrogen move through the watershed.

Using these models, they have evaluated the effectiveness and the cost of a wide range of stormwater management options, including vegetated buffers, rain gardens, and porous pavement. In addition, the investigators prepared a comparison of ordinances that municipalities could adopt to reduce runoff from developed areas. [(mod ebm wq wq wq res)]

1374 MISSISSIPPI/ALABAMA: 26-mile beach restoration project based on MASGC research

MASGC funded a pilot project to restore a three-acre section of beach on the Mississippi coast. Due to the success of this project, the researchers are restoring 26 miles of hurricane-damaged coastal beach in Harrison County through a \$100,000 grant from the U.S. Army Corps of Engineers. In addition 310 community volunteers provided more than 700 volunteer hours toward the restoration project by planting 7,000 lower beach emergent plants and 3,500 sea oats, saw palmetto, small cabbage palms, wax myrtle, and pines in the upper beach. [R/CEH-18-PD (res)]

1384 MISSISSIPPI/ALABAMA: Sea Grant establishes a GIS-based Habitat Restoration Database.

Sea Grant establishes a GIS-based Habitat Restoration Database: Sea Grant co-sponsored the development of a GIS-Based Website. Impact: Agencies now have a unified and uniform source of information about the type of restoration projects in coastal areas of Mississippi and Alabama, and their specific locations and chronology to improve planning and restoration endeavors and avoid repetitive effort. [R/CCD-9-PD (res)]

946 NEW JERSEY: Sea Grant creates sustainable oyster aquaculture technique to restore bay

A “rack and bag” system developed by New Jersey Sea Grant to culture oysters has been highly successful. The study stimulated industry interest in oyster farming. Resistant oysters (able to withstand the Bay’s high salinity) contribute to the economic and ecological restoration of the Delaware Bay’s oyster resources. Marketing efforts have resulted in acceptance of Cape May Salt Oysters as a premier oyster product from New Jersey. Currently, five growers are utilizing these Sea Grant-developed techniques. [(fish res)]

104 NORTH CAROLINA: Sea Grant includes oyster focus

Sea Grant has worked with partners on oyster habitat restoration efforts that have resulted in increased attendance at the 2007 Oyster Summit, increased public awareness and greater participation in the conservation and restoration of oysters reefs. In addition, Sea Grant has provided leadership for a coast-wide oyster larvae monitoring program. [A/EA-10 (res fish)]

528 NORTH CAROLINA: Rocky Branch project continues

Through stream and estuarine restoration projects, more than 400 school children, college students and working professionals have been exposed to state-of-the-art restoration practices focused on restoring urban streams. In addition, 1000 feet of Rocky Branch were restored using natural channel design, 15,000 square feet of accessible floodplain area was created and 235 feet of creek was daylighted. Five stormwater outfalls were equipped with boulder step dissipating structures, 2000 feet of greenway trail developed, including 220 feet of boardwalk suspended above the newly created floodplain and two new bridges across the creek. Habitat for fish and macroinvertebrates was enhanced and streambank erosion and subsequent downstream sediment loading was reduced. Food and cover for urban wildlife was improved by introducing native fruit and nut producing vegetation and shrub vegetation. [A/EA-10 (wq res train)]

945 NORTH CAROLINA: Placement of New Oyster Reefs in Pamlico Sound, NC

A key issue regarding the application of networks of reserves for fisheries and ecosystem-based management is justification for where to locate reserves and at what sizes. North Carolina Sea Grant research has provided scientific justification for determining the location of oyster broodstock reserves in Pamlico Sound, NC, as well as the size of reserves necessary to ensure that the network persists over time. Additionally, this research has demonstrated that oyster densities in reserves have increased 432% in three years, with an average of about 1500 oysters/m², and that growth and survival rates of oysters are high relative to other studies in US estuaries. The results from this study provide solid evidence of the positive response of the oyster population in Pamlico Sound to restoration efforts using mounds of rip-rap placed in no-take broodstock reserves. [R/MRD-56 (ebm prot fish res)]

1083 NORTH CAROLINA: More NC Reefs Benefit from Sea Grant Research

The results of Sea Grant research are being used directly by non-profits and/or government agencies in their design and assessment of ongoing restoration efforts. In 2008-09, Town of St. James, Pender Watch, North Carolina Division of Marine Fisheries and North Carolina Coastal Federation all incorporated aspects of data from this project. [R/MER-53 (res mod)]

1465 NORTH CAROLINA: Sea Grant results improve oyster reef restoration design

The results of Sea Grant oyster reef research are being used directly by non-profits, such as The Nature Conservancy and the N.C. Coastal Federation, in the design and assessment of ongoing restoration efforts. Project results have been presented to state agencies, managers and scientists at the North Carolina Oyster Restoration and Protection Summit in Fall 2007 and at numerous other events, including presentations to community groups eager to take active roles in restoring North Carolina's oyster reefs. (NCSG: Success in Oyster Reef Restoration: Population and Ecosystem Measures, R/MER-53) [R/MER-53 (res)]

258 OHIO: Sea Grant helps local group in \$50 million clean up of Ashtabula Harbor

Statement : Ohio Sea Grant was one of the founding entities of the Ashtabula River Partnership (ARP) in 1994. Sea grant has assisted the ARP in its efforts to develop, design and fund a massive cleanup of the Ashtabula River, an International Joint Commission designated Area of Concern on the Great Lakes, in order to remove and keep over 11,000 kilograms of toxic PCB's from entering the open waters of Lake Erie. Impact: The \$75.2 million environmental dredging of the Ashtabula Harbor started in 2006 is complete. More than 635,000 cubic yards of PCB contaminated sediment from the Ashtabula River in now in a specially designed landfill thus protecting thousands of acres of Lake Erie from pollution by PCB's. [(res wq wq)]

264 OREGON: Fish Habitat Restoration Prioritization Protocols Taking Hold

Many watershed councils and management agencies previously lacked coherent fish habitat restoration plans and failed to prioritize restoration projects based on clear and logical rules, resulting in some publicly-funded projects making little difference in fish habitat availability or quality. This led Guillermo Giannico, Oregon Sea Grant's (OSG) fisheries extension specialist, to take the lead in developing a prioritization of restoration actions protocol. He worked with several partners to organize and develop workshops and seminars on the prioritization methods applicable to restoration work and he produced manuscripts and peer-reviewed publications on the subject (for example, Beechie, T., G. Pess, P. Roni, and G.R. Giannico. 2008. Setting river restoration priorities: a review of approaches and a three-step process for identifying and prioritizing actions. North American Journal of Fisheries Management 28:891–905). This topic has continued to attract the interest and attention of an increasing number of groups as they attend and participate in OSG demonstration projects, training workshops, and presentations around the state. Giannico has accepted several invitations to present on this topic, including two from the University of British Columbia, Canada, and his abstract for an oral presentation was accepted at the 4th International Conference on River Restoration (June 16–21, 2008, Venice, Italy). After Giannico trained the Luckiamute Watershed Council in this prioritization protocol, the council used it as the template for developing its own Action Plan. North coast partners indicated a heightened interest in the prioritization protocol from other northern coastal watershed councils, and several watershed council coordinators requested that OSG begin planning for a regional workshop, involving NOAA staff, on stream assessment, restoration prioritization, and monitoring, to be delivered in late 2009. [(fish res ebm train)]

239 TEXAS: Texas Sea Grant supports coastal restoration in the Rio Grande Valley (2008)

As a member of the Bahia Grande Restoration Team, the Cameron County coastal and marine resources extension agent helped to oversee restoration of the Bahia Grande in what is the largest coastal restoration project undertaken in the United States. Four thousand acres were flooded during the reporting period, bringing the total flooded area to 10,000 acres. [A/F-1 (res)]

241 TEXAS: Texas Sea Grant restores marshlands (2008)

Texas Sea Grant's Jefferson and Chambers counties coastal and marine resources extension agent conducted 18 field laboratory experiences for 411 adults and 21 field labs for 645 young people for a total of 4,224 contact hours. The trips were aboard the Waterborne Education Center boats on the Trinity River out of Anahuac. Funding came from various source, primarily grants procured by WEC. During two youth and one adult field trips conducted by the agent, the groups restored wetlands by planting one half acre of marsh in the Trinity Bay System. *[A/F-1 (train edu edu res)]*

242 TEXAS: Prairie wetland restored at Sheldon Lake State Park (2008)

The Texas Sea Grant Wetland Restoration Team completed the very successful prairie wetland complex restoration at Sheldon Lake State Park, where about 8 acres of former agricultural lands were restored using new aerial photography methodology. The team planted between 5,000 and 7,500 plants, which have since flourished and now completely dominate the entire 8 acres. This project will have a direct impact on improving runoff water quality in the upper Galveston Bay and will provide habitat for waterfowl in the area. The project will have significant impact through the entire region because it has demonstrated how historical aerial photographs can be used to enhance the chances for restoration success. *[A/F-12 (res train wq)]*

243 TEXAS: Wetland restoration in near-inner-city urban setting in Houston (2008)

The Wetland Restoration Team completed a difficult-to-access restoration project in a near-inner-city urban setting in Houston. Sims Bayou has water quality problems like most urban streams within the region. This bayou was once lined with freshwater tidal plants, but lost them due to subsidence. Today there is very little appropriate shelf for planting. But requests by stakeholders in the area resulted in the Team taking on the challenge. Four very difficult sites were revegetated with a mixture of hardy wetland plants including swamp lilies and cutgrass. The sites were unique challenges as they were located downstream within the channel and were only canoe-accessible. The completed acreage was small -- a half mile of shoreline at four sites -- but the project significant in that it demonstrated that restoration could occur even in difficult and degraded urban streams. *[A/F-12 (res)]*

245 TEXAS: Wetlands guidebook used as reference for site restoration, marketing strategy (2008)

The Coastal Communities Development Specialist's book, 'Texas Coastal Wetlands Guidebook,'¹ was used as a reference to support the restoration, beginning in December 2007, of Pine Brook Wetlands, one of three remaining prairie pothole wetlands that are accessible to the public in the Houston area. The book, which cited the location, has been credited with aiding fundraising for the project, in which \$12,000 in donations was raised and 80 volunteers donated 2,000 hours to the project, and with providing background research that facilitated the successful restoration. More than 3,000 invasive species were removed and 1,800 native plants reintroduced to the site. The Pine Brook Wetlands Restoration Project includes two prairie pothole/marshes totaling 13 acres that has had up to 4,000 migrating birds at a time stop over for a few weeks or months on an annual basis. *[A/F-12 (train res)]*

246 TEXAS: Texas Sea Grant monitors wetland project at Brays Bayou for stormwater treatment (2009)

2009 - Wetland Restoration Team efforts continued on the award-winning Brays Bayou stormwater treatment wetland project. This wetland project has received much local attention after winning a Gulf Guardian Award for partnership in 2006 and being featured on local news programs regularly since its completion. The Wetland Restoration Team continued to collect monthly water quality monitoring data (temperature, water clarity, conductivity, dissolved oxygen levels, E. coli presence and quantity) to evaluate the success of the wetland. Collected data suggests this wetland system successfully treats bacteria and other pollutants from runoff. [A/F-12 (res mon wq)]

248 TEXAS: Texas Sea Grant mobilizes volunteers to expand environmental education and habitat restoration (2009)

Six Coastal and Marine Resource (CMR) Agents identified, recruited and trained 86 interns through the Texas Master Naturalist (TMN) program. The TMN program's mission is to develop a corps of well-informed volunteers to provide education, outreach, and service dedicated to the beneficial management of natural resources and natural areas within their communities. Upon certification, these 86 interns joined a cadre of 508 master volunteers overseen by the CMR agents, contributed more than 54,000 hours of volunteer service, the equivalent of 26 full-time employees (GAO), whose time is valued at more than \$1.1 million (independent sector). These Master Naturalists accounted for 36,334 educational contacts to students and teachers through in-school and after-school projects and trainings, and the general public through workshops on EarthKind Landscaping and rainwater harvesting. They also assisted in habitat restoration projects ranging from staking 7,000 recycled Christmas trees on the beach to help rebuild sand dunes, to planting more than 2,500 native marsh, wetland and prairie plants in wildlife refuges. Other projects included repairing state parks damaged by Hurricane Ike and conducting sea turtle patrols in order to locate and mark the nests of these endangered species. Advanced training for some included a 'Keys to Successful Presentations,' which taught the basics of public speaking to large audiences. Six of six (100%) reported they "probably will or definitely will" deliver public seminars as a result of the training. [A/F-1 (train res end)]

1585 WASHINGTON: Sea Grant designs and supports projects to restore shoreline ecological function and reduce harmful land-use practices

Sea Grant works with local governments, state and federal resource management agencies, Native American tribes, private businesses, nongovernmental organizations, conservation groups and private landowners to protect and restore shoreline habitats. The wide range of support services includes ecological assessments, design and review of restoration projects, habitat conservation planning, hazard avoidance, development of alternatives to conventional shoreline armoring, "green" building design and siting, scientific support and public outreach. Impact: Citizens, decision-makers, tribal leaders, local planners, scientists and coastal managers gain an improved understanding of Puget Sound nearshore ecosystems, human impacts, and development and restoration alternatives that contributes to better management and protection of coastal resources and human health and safety. [A/FP-7 (res)]

1591 WASHINGTON: Sea Grant documents the success of natural recolonization of Pacific salmon habitat

Despite substantial funding for stream restoration projects, limited evaluation of outcomes has restricted the ability to learn from mistakes and replicate achievements. Specifically, giving salmon access to habitat from which they had been excluded by dams, culverts and other barriers raises questions of whether they will reenter the habitat and, if they do, will successfully reproduce and build a self-sustaining population. In this Sea Grant-supported research, the number of adult salmon making use of the new habitat, as well as the widespread movements of some salmon above the dam, suggests that exploration is an innate component of salmon breeding behavior. The intrinsic aptitude for dispersal into new areas bodes well for similar projects elsewhere. Impact: Results show the ability of natural processes to re-establish salmon populations in areas from which they had been excluded, arguing against releases of hatchery-produced fish and in favor of natural recolonization. Disseminating the rates and processes of salmon recolonization in the Cedar River will help managers throughout the region identify migration barriers suitable for removal or circumvention. High-profile dam removal or modification projects, such as the Elwha and Klamath rivers, and smaller, less publicized projects will all benefit from the findings. *[R/F-159 (res)]*

1595 WASHINGTON: Sea Grant encourages ecosystem approach to native oyster restoration

The Olympia oyster (*Ostrea conchaphila*) suffered major declines in the Pacific Northwest due to overexploitation and pulp mill pollution and has largely failed to recover despite the removal of these stressors. Predation by the invasive Japanese oyster drill (*Ocenebrina inornata*) is one factor potentially keeping Olympia oysters locally scarce. Sea Grant-supported research has developed predator-prey models to identify biological characteristics of sites where invasive drills pose a high risk to native oysters. Impact: State agencies and nongovernmental organizations can use these models to develop mitigation strategies and to forecast where restoration efforts are likely to fail due to introduced predators. Ongoing native oyster restoration projects by The Nature Conservancy and Puget Sound Restoration Fund are specifically addressing potential risk from oyster drills. *[R/ES-62 (res mod ebm)]*

1598 WASHINGTON: Sea Grant Funds Innovative Seawall Redesign to Enhance Nearshore Ecological Function in Urban Areas

The Seattle seawall is deteriorating and in need of major repairs or replacement. This presents an opportunity to improve ecological function along an urban shoreline with a redesign that includes increased complexity and surface area. The project is located in an area that supports a variety of marine organisms including salmon, and involves design and deployment of vertical hard-substrate habitat “panels.” Impact: This seawall redesign encourages creative engineering solutions in the development of intertidal structures, integration of intertidal habitat enhancement features and innovative conservation efforts where restoration to natural conditions is not feasible. The research will advance basic ecological understanding of significantly altered urban intertidal environments and the ecological mechanisms, processes, and interactions associated with artificial structures. *[R/ES-66 (res)]*

1602 WASHINGTON: Sea Grant leads efforts to enhance environmental benefits of Puget Sound commercial and recreational shellfish harvests

In south Puget Sound, Washington's top molluscan shellfish production area, Sea Grant recruited and trained volunteers to remove debris, reclaim acres of tidelands and improve availability of clams and oysters for public harvest. Tribal, state agency and shellfish industry partners joined with Sea Grant and dozens of community volunteers in workshops, field trips and enhancement activities to provide additional public shellfish resources and increase shellfish filtration of the Sound. Impact: Fifteen acres of shellfish beds have been restored and are now more accessible to the public and tribal harvesters. The shellfish industry and shoreline homeowners are better educated to deal with water quality issues, and some have decided to upgrade their septic systems. *[A/FP-7 (train res wq edu)]*

1638 WASHINGTON: Sea Grant supports assessment and public understanding of dam removal impacts

Dam removal projects have become a popular approach to restoring the habitats of river ecosystems. As a dam ages over time, its negative impacts on river and nearshore communities may outweigh its benefits. However, the full range of effects from restoration is not fully understood. Sea Grant research has collected high-resolution bathymetry, seabed-characterization and sediment-transport data on the Elwha River delta to begin investigations on the dispersal of dam-impounded sediment into the surrounding ecosystem. The information also is being used in public outreach to explain environmental forces that cause sediment to move and cause erosion and deposition. Impact: Agencies involved in baseline monitoring prior to the Elwha Dam removal are making use of Sea Grant data as detailed bathymetry and surficial-materials maps in their assessment of existing habitats. In addition, the public has a better understanding and access to more information to make important decisions on restoration projects. *[R/ES-65 (res edu mon mod)]*

1640 WASHINGTON: Sea Grant Supports Evaluation of Salmon Restoration Efforts

Despite substantial funding for stream restoration projects, there has been little effort to evaluate their effectiveness. Sea Grant research is examining salmon colonization of Cedar River habitat made available by dam modification. The number of returning adults and widespread movements above the dam suggest that exploration is an innate component of breeding behavior and bodes well for similar projects. Impact: Results encourage federal, tribal, state and local managers throughout the region to identify salmon migration barriers suitable for removal or circumvention. *[R/F-148 (res)]*

1648 WASHINGTON: Sea Grant Works to Restore Shoreline Ecological Function and Reduce Harmful Land Use Practices

Sea Grant designs shoreline restoration projects to improve ecological functions and prevent harmful land use practices such as shoreline armoring. Working with ports, tribes, local jurisdictions and private landowners, Sea Grant develops and delivers guidance for activities affecting marine riparian areas to increase awareness and understanding of ecosystem threats. In 2007, Sea Grant technical assistance facilitated the use of natural, "soft bank" materials and restoration methods by 16 low-bank waterfront

homeowners along 1000 feet of shoreline. Impact: The project provided effective home protection while restoring natural waterfront processes. [A/FP-7 (res)]

121 WISCONSIN: Sea Grant research helps managers in controlling cattails in many locations

Boers' findings led Steven Hall to develop a new approach to controlling cattails in Gardner Marsh (UW-Arboretum), a wetland of about 200 ac that is increasingly dominated by hybrid Typha. Research and land care were integrated in a new management plan that the Arboretum adopted. Managers will now rely on the vegetative regrowth and lateral spread of Carex into formerly Typha-dominated marshes and less on seed bank resilience. -This research catalyzed a comparative Typha-management study in Michoacan, Mexico, conducted by Steven Hall with Dr. Roberto Lindig-Cisneros (UNAM-Morelia). Hall, Lindig-Cisneros and Zedler (2008) developed a management recommendation for Michoacan, Mexico based on findings that harvesting Typha 4 times per year increased wetland diversity. Results of project were published in Wetlands. -Sally Gallagher worked with The Nature Conservancy and the Eagle Spring Lake Management District Committee in conveying our understanding of the phosphorus dynamics of the wetlands surrounding Eagle Spring Lake, based on Boers' research. Both partners are interested in managing lake levels to enhance biodiversity. Boers' study shows that fluctuating water would more likely limit the shift from sedge meadow to cattail than would a stable water level. -New information on how native wetland plants grow in response to nutrients, water levels, and topsoil addition was used by the Arboretum to transform three new stormwater facilities into 'Stormwater Management Research Facilities' that will use an adaptive restoration approach to test which diversity level (3 vs. 9 species) and which assemblages (randomly drawn species) perform best in a stormwater infiltration bed, conveyance channel, and detention pond. -Students in Zedler's Botany 670 Lab (Adaptive Restoration) worked with the Wisconsin TNC to develop a restoration and vegetation planting plan for two wetlands at the Mukwonago Reserve following the breaching of a berm. -Zedler supervised a Water Resources Management project for 8 masters students. The class evaluated invasive species problems in the UW-Arboretum's eastern wetlands (200 ac). The group developed an adaptive restoration approach. The WRM report is available on the UW-Arboretum website (<http://uwarboretum.org/research/>). [R/LR-96 (inv res)]

1677 WOODS HOLE OCEANOGRAPHIC INST.: Sea Grant develops an innovative method of bay scallop restoration

Sea Grant worked with local natural resource managers to develop, install and maintain an innovative method of bay scallop restoration: fenced 'corrals' to serve as micro-spawning sanctuaries. Impact: Three towns deployed and continue to maintain these fenced areas, with over 10,000 bay scallops surviving to date. [A/M/O-2 (res)]

1678 WOODS HOLE OCEANOGRAPHIC INST.: Sea Grant helps coastal citizens restore oyster populations

Sea Grant worked with local citizen groups and the natural resource department in Orleans (MA) to deploy over 1,600 bags of 'remote set' oyster seed. Impact: Over fifty citizens volunteered over 300 hours of time to assist with the deployment of the oyster seed. In one location, at least fifteen citizens have been able to go recreationally shellfishing. [A/M/O-2 (res)]

1679 WOODS HOLE OCEANOGRAPHIC INST.: Sea Grant measures the effects of tidal restoration on shellfish and eelgrass populations on Cape Cod

Sea Grant has measured survival and growth of shellfish in response to tidal restoration in two estuaries, East Harbor (Truro/Provincetown) and Herring River (Wellfleet). Impact: This information has been used by the National Park Service and the local municipalities to assess the effects of ongoing or potential tidal restoration in over 400 acres of salt marsh. Sea Grant has measured survival and growth of shellfish in response to tidal restoration in two estuaries, East Harbor (Truro/Provincetown) and Herring River (Wellfleet). Impact: This information has been used by the National Park Service and the local municipalities to assess the effects of ongoing or potential tidal restoration in over 400 acres of salt marsh. *[A/M/O-2 (res)]*